Design and Manufacturing of Scissor Lift with Movable Panels for Material Handling

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Abstract –

A scissor lift or mechanism is a device used to extend or position a platform by mechanical means. The term "scissor" comes from the mechanic which has folding supports in crisscross "X" pattern. The extension or displacement motion is achieved by the application of force to one or more supports, resulting in an elongation of the cross pattern. The force applied to extend the scissors mechanism may by hydraulic, pneumatic or mechanical (via a lead screw or rack and pinion system). The need for the use of lift is very paramount and it runs across labs, workshops, factories to lift load, machine etc. expanded and less-efficient, the engineers may run into one or more problems when in various use. The name scissors lift originated from the ability of the device to open (expand) and close (contract) just like a scissors. Considering the need for this kind of mechanism, estimating as well the cost of expanding energy more that result gotten as well the maintenance etc. it is better to adopt this design concept to the production of the machine. The maximum lift of table is 1380mm and minimum lift of table 800mm. It is has mechanism which is completely mechanical which has lead screw and motor unit for to opening and closing of lift

.***Key Words***:
Hydraulic, Pneumatic, Mechanical, Lead screw, Rack and pinion.

1. INTRODUCTION

Material Handling equipment's are used in movement of bulk, packaged, & individual products within the limits of place of business. A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another in fixed path. Cranes & Hoists is a tower or derrick that is equipped with cables and pulleys that are used to lift and lower material. In industrial or household applications, for lifting material from one level to another level we use cranes, hoists, ladders but using ladders or cranes makes it difficult to lift materials and move to the same level. For coloring of wall it becomes difficult to climb and get down and again move to different level or the same level in different direction. In material handling industry for lifting material and place it on level but in different directions.

To overcome this problem we need to design a system which will be able to lift material and place it on desired level. We will be designing a system containing scissor mechanism which will be operated by DC motors. And to move material on the same level we will be providing a movable panel operated by DC motor.

2. Literature Review

Balkeshwar Singh, Anil Kumar Mishra have worked on "Analysis and Fabrication of Remote Control Lifting Jack" This research paper analyzes the modification of the existing motor screw jack by incorporating an electric motor in the screw in order to make load lifting easier. In this modified design, the power screw is rotated by connecting motor through universal coupling, plugged to the automobile 12 V battery source to generate power for the prime mover (motor), which transmits its rotating speed to the power screw to be rotated with required speed reduction and increased torque to drive the power screw.

The significance and purpose of this work is to modify the existing car jack in order to make the operation easier, safer and more reliable in order to reduce health risks especially back ache problems associated with doing work in a bent or squatting position for a long period of time. The modified car jack is easy to use by women or whoever had problem with the vehicle tyres along the road. The designed motorised jack will also save time and requires less human energy to operate.

Dr. Ramachandra C G, Krishna Pavana, ShivrajShet and Venugopal Reddy, Virupaxappa B have worked on "Design and fabrication of automotive hydraulic jack system for vehicles",Whenever any vehicles undergo a tyre failure, it becomes a very cumbersome task for the person to lift the vehicle from the ground level and lot of manual effort is required even though a jack is used. "Necessity is the mother of all inventions". This quote is a befitting to our project as we believe that man in today's world wants comforts and problem faced by people driving vehicles is more when the vehicle's tyre fails.

Our projects main intention is to reduce the manual work and save time during the replacement of the failed tyre. To validate our point to overcome the difficulties of the above said problems, an inbuilt jack has been designed and fabricated which is assembled on the vehicle. With the help of the existing brake pad and fluid arrangement of the braking system we incorporate the jack into to chassis of the vehicle with a set of unions, ball valves, master cylinder, five-way directional control valve, separated by a piping arrangements lifts the incorporated jack to action desired without raising any sweat of the driver.

M.M.Noor, K.Kadirgama, M.M.Rahman, M.S.M.Sani, M.R.M.Rejabhave worked on "Development of Auto Car Jack Using Internal Car Power", Car jacks usually use mechanical advantage to allow a human to lift a vehicle by manual force. More powerful jacks are using hydraulic power to provide more lift over greater distances. This paper presents the development of the car jack for emergency use with using internal cigarette lighter power (12volts). The automatic easy car-jack utilizes this power source to save individuals having to exert any energy. To increase the lifting power in order to ensure the power is adequate, gear ratio was used. The car jacker was developed utilizing the Solidworks and its analyses to check the safety factor and force acting. The fabrication work has been done with milling and grinding machine. The car jacker will be tested and it predicted to have enough power to lift and holding the car as normal car jacker.

Helmi Rashida, MohdKhairolAnuarMohdAriffinb, Mohd Hafiz MohdNoha, Abdul Halim Abdullaha, Ahmad Hussein Abdul Hamida, Mohammad Azzeim Mat Jusoha, Akbar Othmanchave worked on "Design Review of Scissors Lifts Structure for Commercial Aircraft Ground Support Equipment using Finite Element Analysis", This research reviews scissors lifts structure manufactured by AEREX, UMW Advantech Sdn. Bhd. that is used on a catering hi-lift using Finite Element Analysis (FEA). The scissors lifts are one of the major and crucial components of a catering hi-lift which is mainly used tohoist the van body of the catering hi-lift for aircraft servicing. The catering hi-lift is one of the aircraft ground support equipment that is commonly used to service commercial airliners. For the design to be approved by the Department of Safety and Health (DOSH) Malaysia under Hoisting Machine Design according to DS-149 Standard, it must comply with specific engineering design standard. The only standard applicable is the ANSI Standard MH29.1-2003 "Safety Requirements for Industrial Scissors Lifts" (Revision on ANSI MH29.1-1994).

Focusing on the deflection accordance to the ANSI Standard; calculation regarding the allowable maximum deflection must not be exceeded. To analyze, manual calculations, solid modeling and computer simulations were involved using state-of-the-art CAE software. Several linear static FEA analyses were done to get accurate results. The results show that the deflection is still in the acceptable range. However, some manufacturers find that the allowable maximum deflection is too excessive. Therefore, advice on critical areas to the application must be given and other safety precautions must be taken to avoid failure during operation.

Bharath Kumar K, Bibin George Thomas, Gowtham S., Kiron Antony Rebeiro, Paul James Thadhani, Deepak Kumar R, has worked on "Fabrication of Zig Zag Pneumatic Lift" This project is developed for the users to lift any weight using air pressure. High pressure air is stored in a tank. Acylinder with piston arrangement is connected with a zig-zag pattern. Two pipes connected with ball valves connect the air tank with the cylinder. When one valve is opened, the air rushes out into the cylinder.

Therefore, the piston moves in one direction. The rod connected with the piston pushes the zig-zag frame so that the lift moves up. When the other ball valve is opened, the air inside the cylinder is released. Therefore, the lift comes down.We make this project entirely different from the other projects.The concept involved in our Project is very easy. We use pneumatic cylinder with piston attached inside and this cylinder is in turn attached to a zig-zag frame and when the compressed air is passed through the tube it makes the cylinder working and in return the lift will start to raise to its maximum height and when the air flow is made to stop then the lift will come back to its original position. By doing this project we understood the working principle of a zig-zag pneumatic lift their benefits, advantages and disadvantages.

Jaydeep m. bhatt, milan j. pandya have worked on "Design and analysis of an aerial scissor lift",The following paper describes the design as well as analysis of a simple aerial scissor lift. Conventionally a scissor lift or jack is used for lifting a vehicle to change a tire, to gain access to go to the underside of the vehicle, to lift the body to appreciable height, and many other applications Also such lifts can be used for various purposes like maintenance and many material handling operations. It can be of mechanical, pneumatic or hydraulic type.

The design described in the paper is developed keeping in mind that the lift can be operated by mechanical means so that the overall cost of the scissor lift is reduced. Also such design can make the lift more compact and much suitable for medium scale work. Finally, the analysis is also carried out in order to check the compatibility of the design values.With such a design of an aerial scissor lift, the complexities in the design can be reduced. Also with such design parameters, the manufacturing time of an aerial scissor lift can be reduced. So such a designcan be used for production in industries. The analysis on ANSYS has also shown that the design is safe under certain accepted parameters. Also further modifications can be implemented for optimizing the design and further analysis can also be carried out by finding other important parameters related to aerial scissor lifts.

Ivan Sunit Rout, Dipti Ranjan Patra, SidharthaSankarPadhi, Jitendra Narayan Biswal, Tushar Kanti Panda have worked on "Design and Fabrication of motorized automated Object lifting jack", Object lifting jacks are the ideal product to push, pull, lift, lower and position loads of anything from a couple of kilograms to hundreds of tonnes. The need has long existed for an improved portable jack for automotive vehicles. it is highly desirable that a jack become available that can be operated alternatively from inside the vehicle or from a location of safety off the road on which the vehicle is located.

Such a jack should be light enough and be compact enough so that it can be stored in an automobile trunk, can be lifted up and carried by most adults to its position of use, and yet be capable of lifting a wheel of a 4000-5000-pound vehicle off the ground. Further, it should be stable and easily controllable by a switch so that jacking can be done from a position of safety. It should be easily movable either to a position underneath the axle of the vehicle or some other reinforced support surface designed to be engaged by a jack. Thus, the product has been developed considering all the above requirements. This particular design of motorized automated object lifting jack will prove to be beneficial in lifting and lowering of heavy loads.

Rahul J.Kolekar, S.S.Gawadehas worked on "Design and development of lift for an automatic car parking system", Metropolitan cities strongly need advanced parking systems, providing drivers with parking information. Existing parking systems usually ignore the parking price factor and do not automatically provide optimal car parks matching drivers' demand. Currently, the parking price has no negotiable space; consumers lose their bargaining position to obtain better and cheaper parking. This dissertation study gives an automatic car parking system, and considering negotiable parking prices, selects the optimal car park for the driver.

The autonomous coordination activities challenge traditional approaches and call for new paradigms and supporting middleware. The coordination network is proposed to bring true benefit to drivers and car park operators. This automatic car parking system has capabilities including planning, mobility, execution monitoring and coordination.

Gaffar G Momin, Rohan Hatti, Karan Dalvi, Faisal Bargi, Rohit Devarehas worked on "Design, Manufacturing & Analysis of Hydraulic Scissor Lift", The following paper describes the design as well as analysis of a hydraulic scissor lift. Conventionally a scissor lift or jack is used for lifting a vehicle to change a tire, to gain access to go to the underside of the vehicle, to lift the body to appreciable height, and many other applications Also such lifts can be used for various purposes like maintenance and many material handling operations.

It can be of mechanical, pneumatic or hydraulic type. The design described in the paper is developed keeping in mind that the lift can be operated by mechanical means by using pantograph so that the overall cost of the scissor lift is reduced. In our case our lift was needed to be designed a portable and also work without consuming any electric power so we decided to to use a hydraulic hand pump to power the cylinder Also such design can make the lift more compact and much suitable for medium scale work. Finally, the analysis of the scissor lift was done in ansys and all responsible parameters were analyzed in order to check the compatibility of the design values

P.S. Rana, P.H. Belge, N.A. Nagrare, C.A. Padwad, P.R. Daga, K.B. Deshbhratar

N.K. Mandavgadehas worked on "Integrated Automated Jacks for 4-wheelers",An Automobile hydraulic jack can be easily operated by a single push button provided on the dash board. The jack will be installed on both the sides of chassis according to the weight distributions of the car. Similarly, it will be installed on the other side of the car. The system operates on hydraulic drive which consists of three main parts: hydraulic pump, driven by an electric motor, hydraulic cylinder to lift the vehicle. The hydraulic jacks actuate separately for either side of car as per the breakdown condition.

The car gets lifted and load gets distributed on three point i.e., plunger or ram of hydraulic cylinder and two tires opposite to side which is lifted. This jack will be very useful for all the senior citizens and especially for females (ladies) who find it extremely difficult to operate the jack manually in any breakdown condition. The motive behind using hydraulic system instead of a pneumatic system is the more power produced by the system and simple in design as compared to a pneumatic design. As the hydraulic oil is incompressible so the lifting capacity is more in comparison with the pneumatic system which operates on air which is compressible.

Osman Adil Osman EhabMurtada El-tijanehas worked on "Electrical Car Jack"Side road emergency like tire puncher, is a problem commonly observed in cars. Conventional car jacks use mechanical advantage to allow a human to lift a vehicle by manual force. This paper analyzes the modification of the current toggle jack by incorporating an electric DC motor in the screw in order to make load lifting easier for emergency use with using power of car battery (12 Volts), Gear ratio is used to increase the lifting speed.The significance and purpose of this work is to modify the existing car jack in order to make the operation easier, safer and more reliable in order to save individual internal energy and reduce health risks especially back ache problems associated with doing work in a bent or squatting position for a long period of time.Fabrication work has been done using with milling, drilling, grinding, and welding machine. The developed car jack is tested on car. Implementation of design will solve problem associated with ergonomics. The objective of this project was to Design and manufacture an electrical car jack works through the cigarrete lighter receptacle power output with a button system to raise and lower the car height level.

DivyeshPrafullaUbale, Alan Francy, N.P Sherjehas worked on "Design, Analysis and Development of Multiutility home equipment using Scissor Lift Mechanism", The conventional method of using rope, ladder lift getting person to a height encounter a lot of limitation (time and energy consumption, comfortability, amount of load that can be carried etc.) also there may be a risk of falling down in case of ladders hence hydraulic scissors lift is designed to overcome all these difficulties. The main aim of this paper is design and analysis and to construct a multiutility home equipment for senior citizens so that they can carry their daily activities efficiently. Also the equipment should be compact and cost effective.

Lifting height achieved by scissor mechanism is of 1 m from bottom level. Buckling and bending failure analysis of scissor is also done in this paper. This paper focuses on various aspects related to lifting mechanism and its design. The dimensional, dynamic and strength analysis reflects that the selected mechanism is functional and most likely reliable for its purpose. The portable work platform is operated by hydraulic cylinder which is operated by a motor. Also whole device is motorized and with help of control panel allows user to travel from one place to other. The scissor lift can be designed for high load also if a suitable high capacity hydraulic cylinder is used. The hydraulic scissor lift is simple in use and does not require routine maintenance. In this paper we carried out detailed analysis of scissor mechanism members against bending and buckling failure and also focused on various design aspects and working of scissor mechanism.

M. Kiran Kumar, J. Chandrasheker, Mahipal Manda, D.Vijay Kumarhas worked on

"Design & Analysis of Hydraulic Scissor Lift", This paper is mainly focused on force acting on the hydraulic scissor lift when it is extended and contracted. Generally, a hydraulic scissor lift is used for lifting and holding heavy weight components. Material selection plays a key role in designing a machine and also influence on several factor such as durability, reliability, strength, resistance which finally leads to increase the life of scissor lift. The design is performed by considering hydraulic scissor lift as a portable, compact and much suitable for medium type of load application. Drafting & drawing of hydraulic system scissor lift is done using solid works with suitable modeling and imported to Ansys work bench for meshing and analysis. Hence, the analysis of the scissor lift includes Total deformation load, Equivalent stress, was done in Ansys and all responsible parameters were analyzed in order to check the compatibility of the design value. The computational values of two different materials such as aluminum and mild steel are compared for best results.

Tian Hongyu, Zhang Ziyihave worked on “Design and Simulation Based on Pro/E for a Hydraulic Lift Platform in Scissors Type”, Scissors lift platform with a wide range, the main platform, lift mechanism and the bottom are composed of three parts. Lifting from low to high lifting, the scissors posts, and the hydraulic cylinder layout multiple, mobile way has traction, self-propelled, booster, etc. Scissors lift mechanism of scissors post number and cylinder layout by lifting height. This paper is about a design based 3D software Pro/E with 8m high scissors lift platform, which gives a entire platform dimension with 1800 × 900mm2. A rated load of features so that the whole platform can be set up by two pairs of scissors refers to like products. The platform is designed to be folded away doors, to save more space for convenient storage. Lift platform uses a hydraulic driver, which runs smoothly, stably, and accuracy factors relative to high.

Doli Rani, Nitin Agarwal Vineet Tirth have worked on “Design and Fabrication ofHydraulic Scissor Lift”, The following paper describes the design as well as analysis of a hydraulic scissor lift having two levels. Conventionally a scissor lift or jack is used for lifting a vehicle to change a tire, to gain access to go to the underside of the vehicle, to lift the body to appreciable height, and many other applications. A Scissor lift is the type platform that can usually move vertically.

This mechanism is achieved by the use of link, folding support in crisscross pattern known as a Pantograph. The upward motion is achieved by the application of pressure to outside of the lowest set of support elongating the crossing pattern and propelling the work platform vertically. This paper describes the complete study of components (hydraulic cylinder, scissor arms, spacing shaft and platform), selection of materials and analyzes the dimensions of components along with their sketches with the help of design software CATIA V5 followed by stress analysis on COMSOL. Further fabrication of all the parts and assembly is carried out.

Bhavin H Mehta, MehulG.Joshi, UtsavM.Dholakiyahave worked on “Design and Analysis of Screw Operated Lifting Equipment”, The project relates to the lifting equipment or more particularly to a scissor jack for lifting a body to appreciable height that can be used for a various purpose like maintenance and many material handling operations. The mode of operation can be a mechanical, pneumatic or hydraulic. Mechanical mode of operation is suitable for the medium scale work, and precise range of application, where elevation for extended period of time is required, precisely without drifting.

So the project is aimed with an objective to design the Screw Operated Lifting Equipment, for the maintenance purpose of the building with ceiling height of 1.625 m along with four workmen each weighting 80 kg along with their equipments. So this lifting equipment is designed for load carrying capacity of 500 kg keeping F.O.S – 1.4(with the reference of research paper), which overcomes the limitations of the hydraulic scissor lift in Repeatable positioning in the millimeter range even at high speed, maintaining the position with no drift at specified elevation for extended period of time, completely smooth motion and uniform speed, constant force and lifting speed, low vibration and noise, etc.

M. Abhinay, P.Sampath Rao, have worked on “DESIGN AND ANALYSIS OF AN AERIAL SCISSOR LIFT”, Aerial scissor lifts are generally used for temporary, flexible access purposes such as maintenance and construction work or by fire-fighters for emergency access, etc which distinguishes them from permanent access equipment such as elevators. They are designed to lift limited weights — usually less than a ton, although some have a higher safe working load (SWL).

The increasing demand of Aerial Scissor Lifts in companies in order to improve their manufacturing flexibility and output by providing variable height access to their work. This is especially true when the work being accessed is raised off the floor and outside an operator’s normal ergonomic power zone. In either case, it is much more economical to bring the worker to the work rather than bringing the work to the worker. In this project, we have modeleda aerial scissor lift by using ANSYS software which is one of the software used for modeling components in most of the design based industries. While the modeling of the components the material selection is carried out simultaneously based on the design considerations related to loads, etc. Later the stress and strain concentration, deformation on the aerial scissor lift have been found by applying certain load on the lift’s platform, using the Finite Element Analysis (FEA) by using ANSYS software that provides best output within few seconds. Finally, the stress and strain concentration, deformation results are presented in the report section of this document.

JaideepChitransh,Dilshad Hussain has worked on “Designing and calculating the stresses induced in scissor jack for three different materials”

A Scissor Jack is a mechanical device used to lift a heavy vehicle from the ground for changing the wheeland for maintenance purpose. The most important fact of a jack is that, it gives the user a mechanical advantage by changing the rotational motion into linearmotion and allowing user to lift a heavy car to the require height. In this work we have designed different components of scissors jack using CAE tools i.e. CATIAandCalculate stresses induced in its different partwhich are responsible for failure and To Reduce its cost, sothat everyone can afford this. We have taken reference of Mahindra Bolero Scissors Jack.The Dimensions of scissors jack was measured by Vernier calliper. By measuring all the dimensions of components of scissors jack,we have designed it in CATIA, afterthat we assemble all the components of Jack to shape a model of scissors jack and calculated different parameters (Max. shearstress, Max. principal Tensile Stress, Totaltorque required to lift the vehicle etc) whichis used in all components of scissors jack to avoid failure. To reduce the cost of jackwe have taken twodifferent sections of three different materials i.e. Mild Steel, AISI 1045grade Steel, GS-52.3 Cast Steel and comparing which will be suited for above mentioned purpose.By using these materials, we have calculate and compare the Strength to weight ratio and find which material is best suited for high load carrying capacity with minimum failure or deformation.

3. WORKING PRINCIPLE

A scissor lift, or commonly called as a table lift, is mainly used to lift people upwards with its crisscrossing foundation supporting beneath the platform. As the platform pulls itself together, it moves upright in the vertical direction and push the platform in accordance with the height and weight. These lifts can be controlled through hydraulic, pneumatic or mechanical power for height extension. Originally delivered in numerous sizes and shapes, it is designed and manufactured as an industrial lift, and has been customized for commercial and comprehensive purposes.

Scissor lifts typically operate in two axis of movement and are designed for applications where people and material need only up and down travel (stationary lift), where the lift needs to be moved around to perform work (manually positioned lift), or to access work along a fixed area of travel (rail guided lift). Classification

1. According to lift type
· Single leg set
· Multiple height
· Multiple width
· Multiple length

2. According to energy used
· Hydraulic
· Pneumatic
· Mechanical

3. According to mounting
· Surface
· Pit
· Mobile

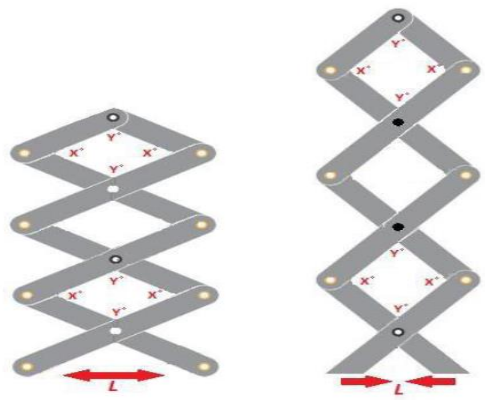

Fig1.1 Scissor Lift Mechanism

According to lift type:

1. Single leg set
Single leg set is the most commonly used lft type. It offers stability and can heavy, evenly distributed loads.

Fig 1.2 single leg set

Fig 1.2 single leg set

2) Multiple height
A multiple height lift is made up of two or more legs sets. These types of lifts are used to achieve a high travel with a relatively short platform.

Fig 1.3 single leg set

3) Multiple width
Multiple width lift is made up of two or more single leg sets, side by side, with a common top and base frame. It is used for loads with large plan view dimensions.

Fig 1.4 Multiple width

4) Multiple length
Multiple length is made up of two or more single leg sets, end to end, with common platform and base frame. It is used when very long loads must be handled, such as long length pipes or lumber

Fig 1.5 Multiple length lift

According to energy used:

1. Hydraulic lift

Hydraulic scissors lifts provide the most economical, dependable, and versatile method of lifting heavy loads. Hydraulic lifts have few moving parts, are well lubricated, and provide many years of trouble free operation. These scissors tables raise the loads smoothly to any desired height, and can be easily configured to meet the specific speed, capacity, and foot print requirement of any hydraulic lifting application. Each hydraulic scissors lift is designed and manufactured to meet the industry safety requirements and is by far the most popular and efficient of all styles of scissors tables used in material handling applications.

Fig 1.6 Hydraulic lift

2. Pneumatic lift

These are operated by air pressure and are highly efficient because the supply is made by compressing atmospheric air. Most units require no electricity and can be used in anywhere that air is available. (Many manufacturing warehouses have air supplied throughout for the use of pneumatic tools.) Because there is no hydraulic fluid, there is no potential for line contamination, so these lifts require less maintenance.

Fig1.7 Pneumatic scissor lift

3. Mechanical lift

The mechanical scissor lift is used for lifting materials especially on construction sites. This is one of the most recent advancement on scissor lift. There, the lift utilizes a belt drive system connected to a load screw which constructs the “X” pattern on tightening and expands it on loosening. The lead screw actually does the work, since the applied force from the wheel is converted to linear motion of the lift by help of the lead screw. This can be used to lift the working and equipment to a height.

A general knowledge however, regarding screws will reveal the loss due to friction in the screw threats. Therefore, the efficiency of this device is low due to losses in friction. Also, the power needed to drive the machine is manual, and much energy is expanded to achieve a desired result. Its suitability however, cannot be over-emphasized as it can be used in almost every part of the country whether there is availability of electricity or not. While lifting most of the Muscular energy is converted into mechanical energy and increase the stress on the links.

This project consists of stress analysis on elements of mechanical based car lift for firm lifting and steady condition. The load distribution on the lift causes various stresses i.e. shear, bending, tensile etc. In order to get the stable and accurate result of element size, time step selection is very important and all of these aspects are feasible or not.

Fig 1.8 Mechanical lift

3 According to mounting:

1. Surface

Lifts are surface mounted when the lowered height dose not interfere with the application. For example: if the lift is lowered as material is stacked on the pallet and the pallet is then removed by a fork truck, the lowered height of the lift dose not interfere with the application because the fork truck does not need to drive on to the lift to pick up the loaded pallet.

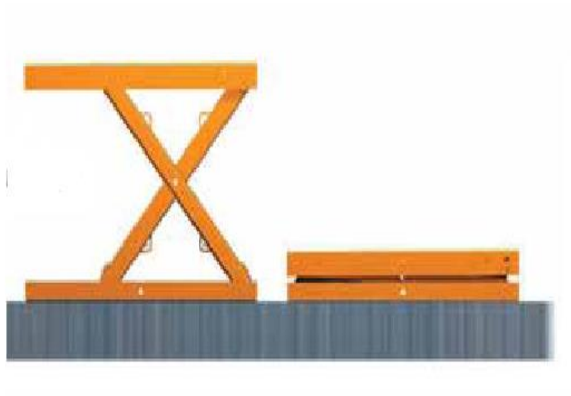

Fig1.9 Surface mounted

2. Pit mounted

Lifts are pit mounted when the platform must be flush with the surrounding surface. For example: if the lift is lowered as materials are stacked on the pallet and the pallet is then removed by the pallet jack, the platform must flush with the surrounding surface because the pallet jack must be able to roll on to the lift platform to remove loaded pallet.

Fig 1.10 Pit mounted

3. Mobile

A lift is mobile or portable when it must serve more than one work station. A mobile lift can be manual or power driven. Mobile lift can also be used to transport the load from one location to another. The lift can be track mounted or have fixed or movable caster wheels for maneuver ability

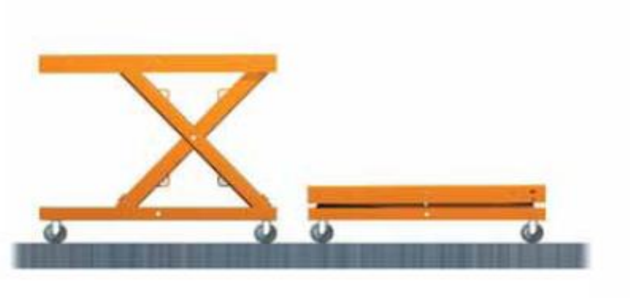

Fig 1.11 Mobile Mounted

4. DESIGN OF SCISSOR LIFT COMPONENTS

A. Lead Screw:

A lead screw (or lead screw), also known as a power screw or translation screw, is a screw used as a linkage in a machine, to translate turning motion into linear motion. Because of the large area of sliding contact between their male and female members, screw threads have larger frictional energy losses compared to other linkages. They are not typically used to carry high power, but more for intermittent use in low power actuator and positioner mechanisms. Common applications are linear actuators, machine slides (such as in machine tools), vises, presses, and jacks. Leadscrews are manufactured in the same way as other thread forms (they may be rolled, cut, or ground). A lead screw is sometimes used with a split nut also called half nut which allows the nut to be disengaged from the threads and moved axially, independently of the screw's rotation, when needed (such as in single-point threading on a manual lathe).

B. Square thread:

Square threads are named after their square geometry. They are the most efficient, having the least friction, so they are often used for screws that carry high power. But they are also the most difficult to machine, and are thus the most expensive.

C. Acme thread:

Acme threads have a 29° thread angle, which is easier to machine than square threads. They are not as efficient as square threads, due to the increased friction induced by the thread angle. ACME Threads are generally also stronger than square threads due to their trapezoidal thread profile, which provides greater load-bearing capabilities.

D. Buttress thread:

Buttress threads are of a triangular shape. These are used where the load force on the screw is only applied in one direction. They are as efficient as square threads in these applications, but are easier to manufacture.

E. Problem Statement:

In industrial or household applications, for lifting material from one level to another level we use cranes, hoists, ladders. But using ladders or cranes makes it difficult to lift materials and move to the same level. For colouring of wall it becomes difficult to climb and get down and again move to different level or the same level in different direction. In material handling industry for lifting material and place it on level but in different directions it is difficult. To overcome this problem we need to design a system which will be able to lift material and place it on desired level. We will be designing a system containing scissor mechanism which will be operated by DC motors. And to move material on the same level we will be providing a movable panel operated by DC motor

5. DESIGN CALCULATIONS

1 Design Of Lead Screws For Z Axis:

Lead screw length 400 mm is considered lead screw selection for z axis movement.

Weight of the motor will act vertically downward direction to the shaft

Forces acting on the lead screw

1. Weight of Above Structure Of Pannel.
2. Support reaction at both end of lead screw.

Hence

Total weight = Weight Of Structure

= 75 Kg

= 735.75 N

Now consider the Free Body diagram of the Lead Screw (shaft)

It is assumed that the whole assembly is at centre of the lead screw

On solving the FBD

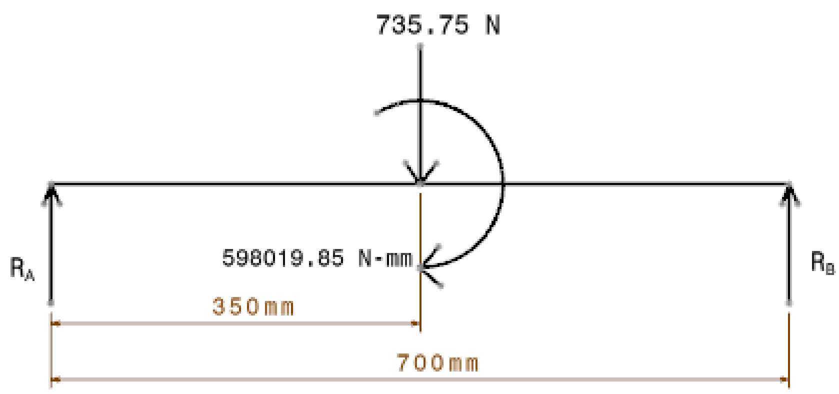

Fig 3.1: Free Body Diagram of Z Axis Lead Screw.

$$\sum F_Y = 0$$

$$R_A + R_B = 735.75 \text{ N}$$

$$\sum M_A = 0$$

$$735.75 \times 350 \ + \ 598019.85 - R_B \times 700 = 0$$

$$R_B = 1222.15\ \text{N}$$
$$R_A = -486.4\ \text{N}$$

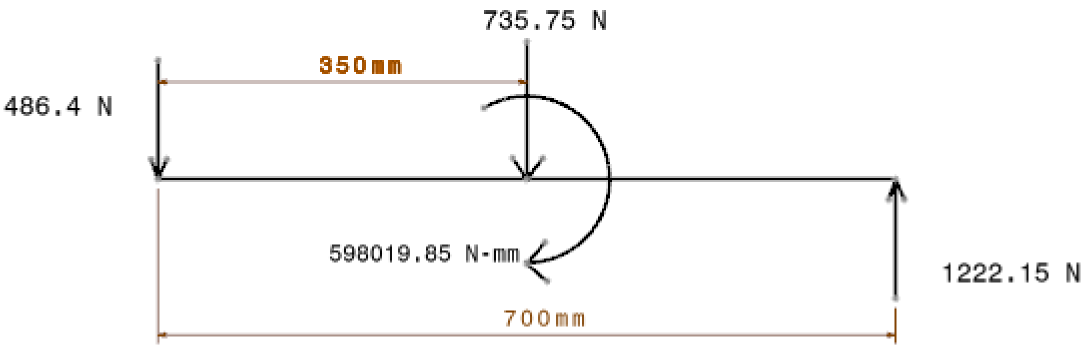

Fig 3.2: Free Body Diagram of Z Axis Lead Screw

Bending moment at A = 0 N mm

Bending moment at C = 427779.85 N mm

Bending moment at B = 0 N mm

$$M_{max} = 427779.85\ \text{N mm}$$
$$T_{max} = 598000\ \text{N mm}$$

Material of the lead screw = mild steel

$$S_{yt} = 370\ \text{Mpa}$$
$$\text{Factor of Safety} = 3.5$$

$$\tau_{Perm} = \frac{\text{Sys}}{\text{factor of safety}}$$

$\tau_{Perm} = \frac{0.5 \times S_{yt}}{\text{factor of safety}}$

$$\tau_{Perm} = \frac{0.5 \times 370}{3.5}$$

$$\tau_{Perm} = 52.8571\ \text{Mpa}$$

Hence the lead screw diameter can be find by ASME code

$$\tau_{Max} = \frac{16}{\pi \times D^3} \times \sqrt{M_{Max}^2 + T_{Max}^2}$$

$$\tau_{Perm} = \tau_{Max} = \frac{16}{\pi \times D^3} \times \sqrt{M_{Max}^2 + T_{Max}^2}$$

$$52.8571 = \frac{16}{\pi \times D^3} \times \sqrt{(427779.85\,)^2 + (598000)^2}$$

$$D = 41.37 \text{ mm}$$

$$D = 42 \text{ mm}$$

3.2 Design Check For Middle Block:

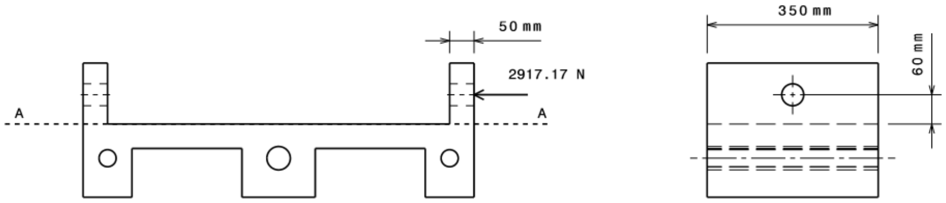

Fig 3.3: Thrust Force Acting On Middle Block While Drilling Operation.

Material used = mild steel

$$S_{yt} = 370 \text{ Mpa}$$

$$\text{Factor of Safety} = 3$$

$$\sigma_{Perm} = \frac{Syt}{\text{factor of safety}} = \frac{370}{3}$$

$$\sigma_{Perm} = 123.33 \text{ Mpa}$$

$$\tau_{Perm} = \frac{Sys}{\text{factor of safety}}$$

$\tau_{Perm} = \frac{0.5 \times S_{yt}}{\text{factor of safety}}$

$$\tau_{Perm} = \frac{0.5 \times 370}{3}$$

$\tau_{Perm} = 61.66 \text{ Mpa}$

$$\sigma_{bending} = \frac{M_b \times Y}{I}$$

$$M_b = F \times X = 2917.17 \times 60$$

$$= 175030.2 \text{ Nmm}$$

$$Y = 25 \text{ mm}$$

$$I = \frac{B \times D^3}{12} = \frac{350 \times 50^3}{12} = 3645833.33 \text{ mm}^4$$

$$\sigma_{bending} = \frac{175030.2 \times 25}{3645833.33} = 1.200 \ {}^{N}/_{mm^2}$$

$$\tau = \frac{Force}{Area} = \frac{2917.17}{350 \times 50} = 0.1667 \ {}^{N}/_{mm^2}$$

Maximum reaction = 1222.15 N = 1223 N

$$\tau = \frac{Force}{Area} = \frac{1223}{350 \times 50 - (45 \times 50)} = 0.0801 \ {}^{N}/_{mm^2}$$

As all stresses are within permissible limit hence design is safe.

3.3 Design Of Lead X Direction Lead Screw:

The lead screw which guide the drilling head in x direction i.e. in horizontal direction
Forces acting on the lead screw

1) Weight of the drilling Head along with the motor & weight of block to mount the motor is act on the lead screw at the centre
2) Weight of the z axis lead screw and weight of lead screw holding block at the centre of lead screw.

Total weight = weight of the motor + weight of motor holding block + weight of z axis lead screw + weight of z axis holding lead screw block

$$W = 15 \text{ Kg} + 60 \text{ Kg} + 10 \text{ Kg} + 240 \text{ Kg}$$

$$W = 325 \text{ Kg} \cong 350 \text{ Kg}$$

$$W = 3433.5 \text{ N}$$

Now consider the Free Body diagram of the Lead Screw (shaft)

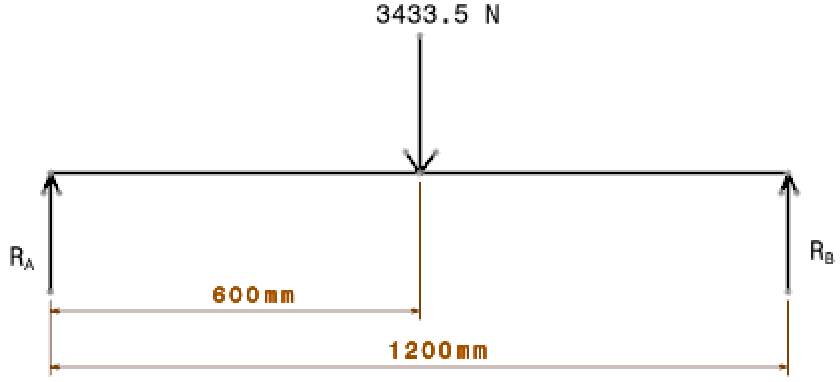

Fig 3.4: Free Body Diagram of X Axis Lead Screw

It is assumed that the whole assembly is at centre of the lead screw

On solving FBD

$$\sum F_Y = 0$$

$R_A + R_B = 3433.5 \text{ N}$

$$\sum M_A = 03433.5 \times 0.6 - R_B \times 1.2 = 0$$

$$R_B = 1716.75 \text{ N}$$

$$R_A = 1716.75 \text{ N}$$

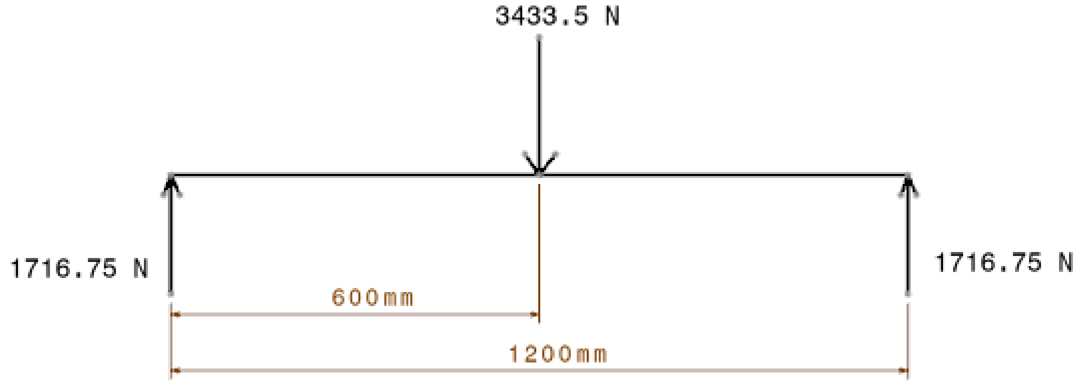

Fig 3.5: Free Body Diagram of X Axis Lead Screw

Bending moment at A = 0 N-mm

Bending moment at C = 1030050 N-mm

Bending moment at B = 0 N-mm

$$M_{max} = 1030050 \text{ Nm} T_{max} = 0 \text{ Nmm}$$

Material of the lead screw = mild steel

$$S_{yt} = 370 \text{ Mpa}$$

$$\text{Factor of Safety} = 3.5$$

$$\tau_{Perm} = \frac{Sys}{\text{factor of safety}}$$

$$\tau_{Perm} = \frac{0.5 \times S_{yt}}{\text{factor of safety}}$$

$$\tau_{Perm} = \frac{0.5 \times 370}{3.5}$$

$$\tau_{Perm} = 52.8571$$

Hence the lead screw diameter can be find by ASME code

$$\tau_{Max} = \frac{16}{\pi \times D^3} \times \sqrt{M_{Max}^2 + T_{Max}^2}$$

$$\tau_{Perm} = \tau_{Max} = \frac{16}{\pi \times D^3} \times \sqrt{M_{Max}^2 + T_{Max}^2}$$

$$52.8571 = \frac{16}{\pi \times D^3} \times \sqrt{(1030050)^2 + (0)^2}$$

$$D = 46.29 \text{ mm}$$

$$D = 48 \text{ mm}$$

3.4 Design of Scissor Lift:

Scissor lift include following important part

1) top plate

2) scissor link

3) base plate

3.4.1 Top plate [c section]:

Design for C section

Total weight top plate = weight of the motor + weight of motor holding block + weight of z axis lead screw + weight of z axis holding lead screw block + weight of y axis lead screw + weight of x axis two guide shaft + weight of x axis lead screw and guide shaft holding L plate

$$W = 15\ Kg + 60\ Kg + 10\ Kg + 240\ Kg + 15\ \ Kg\ + 10 \times 2\ \ Kg + 100\ \ Kg$$

$$W = 460\ Kg \cong 500\ Kg$$

$$W = 4905\ \ N$$

Now consider the Free Body diagram of the c section

It is assumed that the whole assembly is at mid-point of the c section

On solving FBD

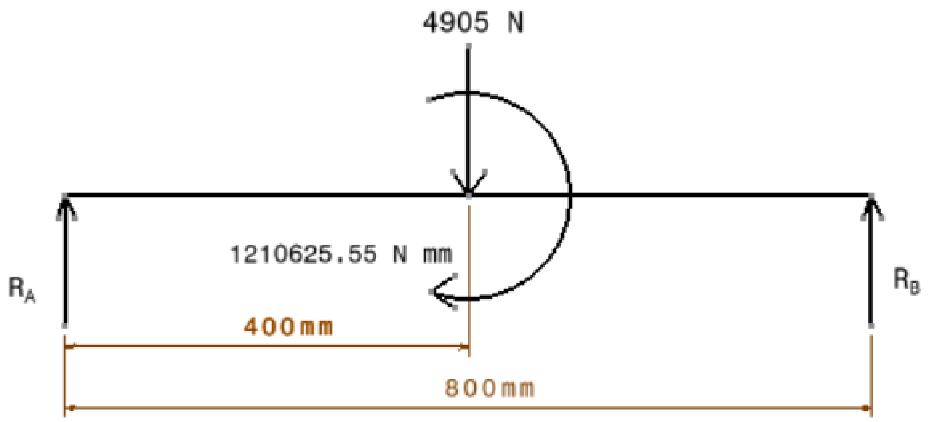

Fig3.6: Free Body Diagram of C section

$$\sum F_Y = 0$$

$$R_A + R_B = 4905\ N$$

$$\sum M_A = 0$$

$$4905 \times 400 + 2917.17 \times 415\ - R_B \times 800 = 0$$

$$R_B = 3965.78\ \ N$$

$$R_A\ = 939.21\ N$$

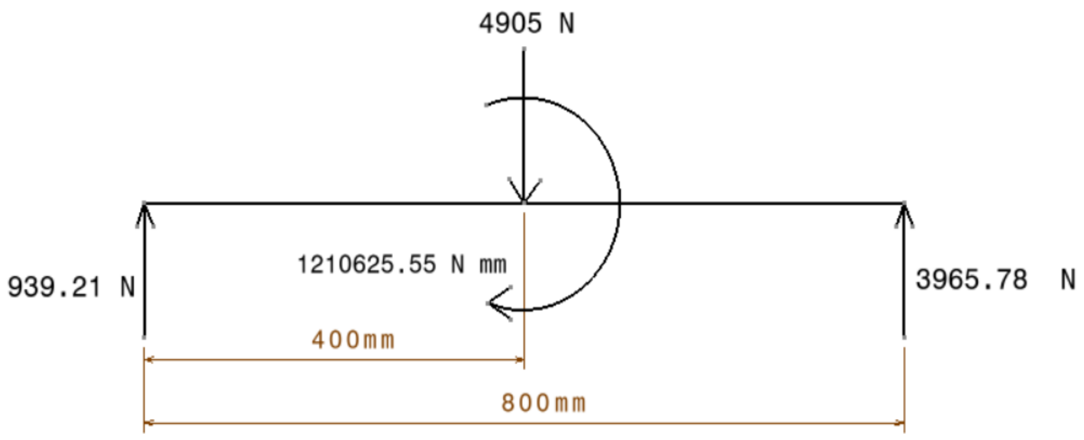

Fig 3.7: Free Body Diagram

Bending moment at A = 0 N-mm

Bending moment at C =939.21×400+2918×415 =1586309.55 N-mm

Bending moment at B = 0 N-mm

Material used = mild steel

$$S_{yt} = 370 \text{ Mpa}$$

$$\text{Factor of Safety} = 3$$

$$\sigma_{Perm} = \frac{Syt}{\text{factor of safety}} = \frac{370}{3}$$

$$\sigma_{Perm} = 123.33 \text{ Mpa}$$

$$\tau_{Perm} = \frac{Sys}{\text{factor of safety}}$$

$\tau_{Perm} = \frac{0.5 \times S_{yt}}{\text{factor of safety}}$

$$\tau_{Perm} = \frac{0.5 \times 370}{3}$$

$$\tau_{Perm} = 61.66 \text{ Mpa}$$

$$\sigma_{bending} = \frac{M_b \times Y}{I}$$

$$M_b = 1.5863 \times 10^6 \text{ Nmm}$$

$$Y = 15 \text{ mm}$$

$$I = \frac{B \times D^3}{12} - \frac{b \times d^3}{12} = \frac{150 \times 800^3}{12} - \frac{120 \times 750^3}{12} = 2.18125 \times 10^9 \text{ mm}^4$$

$$\sigma_{bending} = \frac{M_b \times Y}{I}$$

$$\sigma_{bending} = \frac{1.5863 \times 10^6 \times 15}{2.18125 \times 10^9} = 0.0109 \ {}^{N}/_{mm^2}$$

As all stresses are within permissible limit hence design is safe.

Deflection in c section

Bending moment any section

$$EI\frac{d^2y}{dx^2} = 938.79 \times x - 4905 \times (x - 400) + 1.21097 \times 10^6$$

On integrating

$$EI\frac{dy}{dx} = 938.79 \times x^2 - 4905 \times (x - 400)^2 + 1.21097 \times 10^6 \times (x - 400)^1 + c_1$$

Again On integrating

$$EIy = 938.79x^3 - 4905(x - 400)^3 + 1.21097 \times 10^6 \times (x - 400)^2 + c_1x + c_2$$

On applying conditions $x = 0, y = 0$ then $c_2 = 0$

Again $x = 0.8, y = 0$ then $c_1 = 450.61$

Hence deflection at $x = 400$mm

$$y = \frac{938.79 \times x^3 - 4905(x - 400)^3 + 450.61 \times x}{E \times I}$$

$$y = \frac{938.79 \times 400^3 - 4905(0)^3 + 450.61 \times 400}{210 \times 10^3 \times 2.18125 \times 10^9}$$

$$y = 0.0001311 \text{ mm}$$

3.4.2 Design of scissor link:

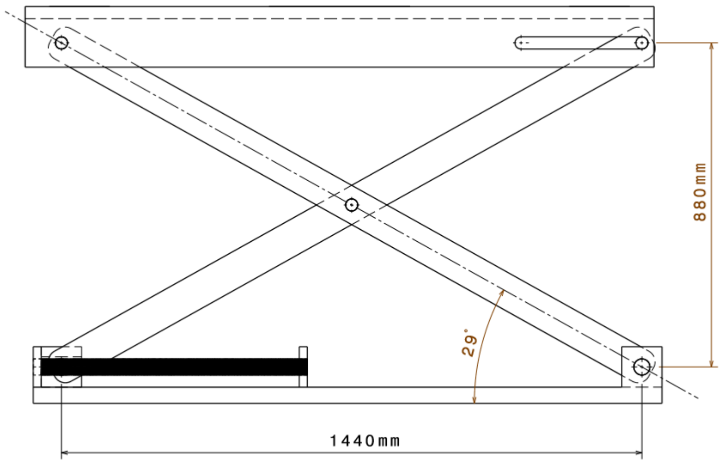

Fig 3.8: Scissor Lift

Length of scissor link can be determining by-

1st case

At top position vertical height is 1380 mm and horizontal length between two link is 900 mm

Length of link is L is given by Pythagoras theorem

$L = \sqrt{(1380)^2 + (900)^2} = 1647.54 \text{ mm} = 1648 \text{ mm}$

2st case

At bottom position vertical height is 800 mm and horizontal length between two link is 1440 mm

Length of link is L is given by Pythagoras theorem

$$L = \sqrt{(800)^2 + (1440)^2} = 1647.54 \text{ mm} = 1648 \text{ mm}$$

Forces acting on the links are

Total weight of the assembly including top plate (c section)

Total weight = weight of the motor + weight of motor holding block + weight of z axis lead screw + weight of z axis holding lead screw block + weight of y axis lead screw + weight of y axis two guide shaft + weight of y axis lead screw and guide shaft holding L plate + weight of the top plate c section

$$w = 15 \text{ Kg} + 60 \text{ Kg} + 10 \text{ Kg} + 240 \text{ Kg} + 15 \text{ Kg} + 10 \times 2 \text{ Kg} + 100 \text{ Kg} + 350 \text{ kg}$$

$$w = 810 \text{ Kg} \cong 850 \text{ Kg}$$

$$W = 8338.5 \ \text{N}$$

Total weight is distributed on two links equally

Force acting on the link

$$f = \frac{w}{2} = \frac{8338.5}{2} = 4169.25 \cong 4170 \text{ N}$$

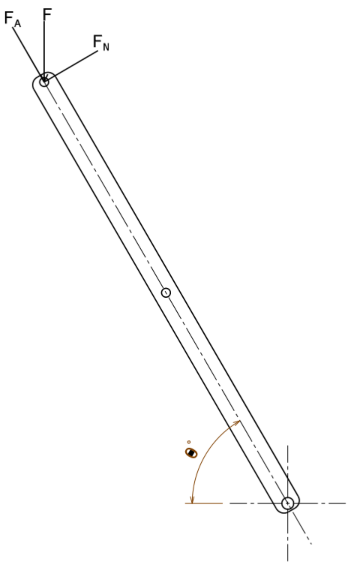

Fig 3.9: Free Body Diagram of Scissor Lift Leg.

This force can resolve in two components

1) axial force(F_A) : Axial force will cause the failure of the link in crushing and buckling failure of link

2) normal force (F_N) : Normal force will cause the bending

Axial force (F_A) = $F \times \sin\theta$

Normal force (F_N) = $F \times \cos\theta$

θ =angle between link and base plate

Hence at top position

$$\sin\theta = \frac{1380}{1648}$$
$$\theta = 56.86$$

Hence at bottom position

$$\sin\theta = \frac{800}{1648}$$
$$\theta = 29.04$$

Therefore from bottom position to top position angle varied from $\theta = 29.04$ to $\theta = 56.86$

For selection of cross section of the link taking the maximum force induced in link while moving the link from bottom position to top position

Force	Angle	Axial force (F_A)	Normal force (F_N)
4170	29	2021.65 N	3647.16 N
4170	34	2331.83 N	3457.08 N
4170	39	2624.26 N	3240.69 N
4170	44	2896.72 N	2999.64 N
4170	49	3174.13 N	2735.76 N
4170	54	3373.60 N	2451.06 N
4170	59	3574.38 N	2147.70 N

Table No 2: Variation of forces from top to bottom position of scissor lift.

Material used for the link = carbon steel

$$S_{yt} = 410 \text{ Mpa}$$

$$\text{Factor of Safety} = 3.5$$

$$\sigma_{Perm} = \frac{Syt}{\text{factor of safety}}$$

$$\sigma_{Perm} = \frac{410}{3.5}$$

$$\sigma_{Perm} = 117.14 \ {}^{N}/_{mm^2}$$

3.4.3 Solid cross section for link:

1) 65 mm × 85 mm

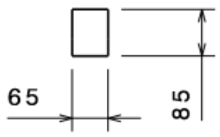

Fig 3.10: Solid Cross Section Of Scissor Leg.

$$\sigma_{crushing} = \frac{FORCE}{AREA}$$

$$\sigma_{crushing} = \frac{3574.38}{85 \times 65}$$

$$\sigma_{crushing} = 0.6471\ {}^{N}/_{mm^2}$$

$$\sigma_{bending} = \frac{M_b \times Y}{I}$$

$$M_b = F_N \times \frac{L}{2}$$

$$M_b = 3647.16 \times \frac{1648}{2} = 3005259.84\ N\ mm$$

$$Y = \frac{85}{2} = 42.5\ mm$$

$$I = \frac{B \times D^3}{12} = \frac{65 \times 85^3}{12} = 3326510.417\ mm^4$$

$$\sigma_{bending} = \frac{3005259.84\ \times 42.5}{3326510.417} = 38.39\ {}^{N}/_{mm^2}$$

$$P_c = \frac{\pi^2 \times E \times I}{4 \times {L_E}^2}$$

$$P_c = \frac{\pi^2 \times 200 \times 10^3 \times 1945260.41}{4 \times \left(\frac{1648}{2}\right)^2}$$

$$P_c = 1413.8165\ KN$$

As all stresses are within permissible limit hence design is safe.

$$\text{weight of leg} = \text{Mass x Gravity} = \rho \times \text{volume} \times g$$

$$\text{Volume} = 85x65x17\ \text{Volume} = 9392500\ mm^3$$

$$\text{weight of leg} = 7.85 \times 10^{-6} \times 9392500 \times 9.81 = 723.30 \cong 725\ N$$

3.5 Design Check For Bottom Rod:

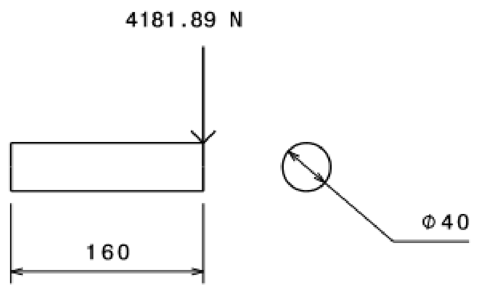

Fig 3.11: Force Acting on Bottom Rod.

Material used = mild steel

$$S_{yt} = 370 \text{ Mpa}$$

$$\text{Factor of Safety} = 3$$

$$\sigma_{Perm} = \frac{Syt}{\text{factor of safety}} = \frac{370}{3}$$

$$\sigma_{Perm} = 123.33 \text{ Mpa}$$

$$\tau_{Perm} = \frac{Sys}{\text{factor of safety}}$$

$$\tau_{Perm} = \frac{0.5 \times S_{yt}}{\text{factor of safety}}$$

$$\tau_{Perm} = \frac{0.5 \times 370}{3}$$

$$\tau_{Perm} = 61.66 \text{ Mpa}$$

Total load on two rods
= Weight of assembly+ weight of two legs

Total load on two rods
= 4170 + 725 × 2= 5620N

Load on one rod= 2810N

Check for shear

$$\tau = \frac{2810}{\frac{\pi}{4} \times 40^2}$$

$$\tau = 2.2361$$

Check for bending

$$\sigma_{bending} = \frac{M_b \times Y}{I}$$

$$Mb = 2810 \times 160$$

$$Y = 20mm$$

$$I = \frac{\pi}{64} \times 40^4$$

$$\sigma_b = \frac{449600 \times 20}{125.66370 \times 10^3}$$

$$\sigma_b = 71.55\, {}^{N}/{}_{mm^2}$$

As all stresses are within permissible limit hence design is safe.

3.6 Design Of Lead Screws For Z Axis:

Forces acting on the lead screw

Now consider the Free Body diagram of the Lead Screw (shaft)

It is assumed that the whole assembly is at centre of the lead screw

On solving the FBD

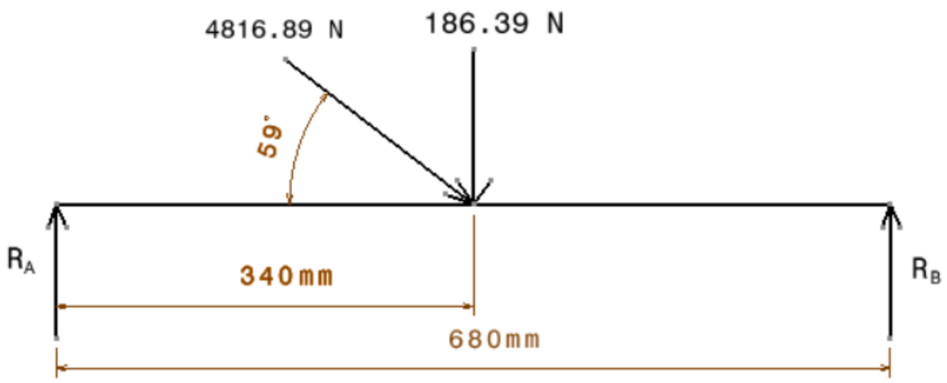

Fig 3.12: Free Body Diagram of Scissor Lift Lead Screw.

$$\sum F_Y = 0 R_A + R_B = 4315.27 \text{ N}$$

$$\sum M_A = 0 4315.27 \times 340 - R_B \times 680 = 0$$

$$R_B = 2157.63 \text{ N}$$

$$R_A = 2157.63 \text{ N}$$

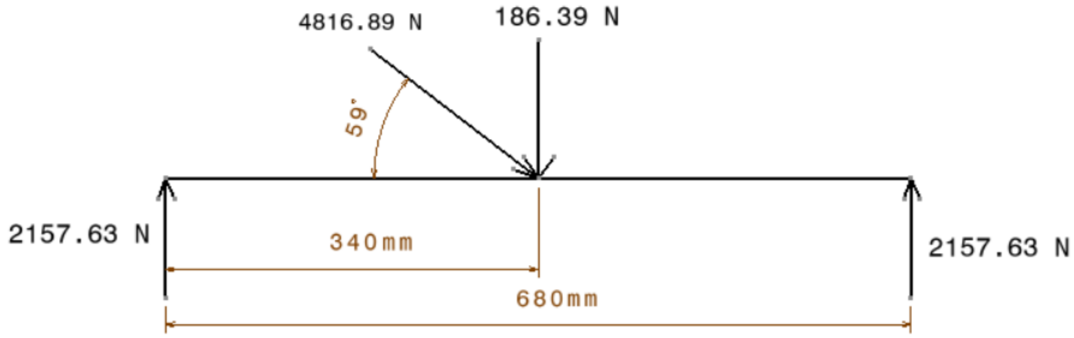

Fig 3.13: Free Body Diagram of Scissor Lift Lead Screw.

Bending moment at A = 0 Nm

Bending moment at C = 733595.9 N mm

Bending moment at A = 0 Nm

M_{max} = 733595.9 N mm

Material of the lead screw = mild steel

$$S_{yt} = 370 \text{ Mpa}$$

$$\text{Factor of Safety} = 3.5$$

$$\tau_{Perm} = \frac{\text{Sys}}{\text{factor of safety}}$$

$$\tau_{Perm} = \frac{0.5 \times S_{yt}}{\text{factor of safety}}$$

$$\tau_{Perm} = \frac{0.5 \times 370}{3.5}$$

$$\tau_{Perm} = 52.8571$$

Hence the lead screw diameter can be find by ASME code

$$\tau_{Max} = \frac{16}{\pi \times D^3} \times \sqrt{M_{Max}^2 + T_{Max}^2}$$

$$\tau_{Perm} = \tau_{Max} = \frac{16}{\pi \times D^3} \times \sqrt{M_{Max}^2 + T_{Max}^2}$$

$$52.8571 = \frac{16}{\pi \times D^3} \times \sqrt{(733595.9)^2 + (0)^2}$$

$$D = 41.34 \text{ mm}$$

$$D = 42 \text{ mm}$$

3.7Detailed Diagram of Each Part of Industrial Portable Drilling Machine:

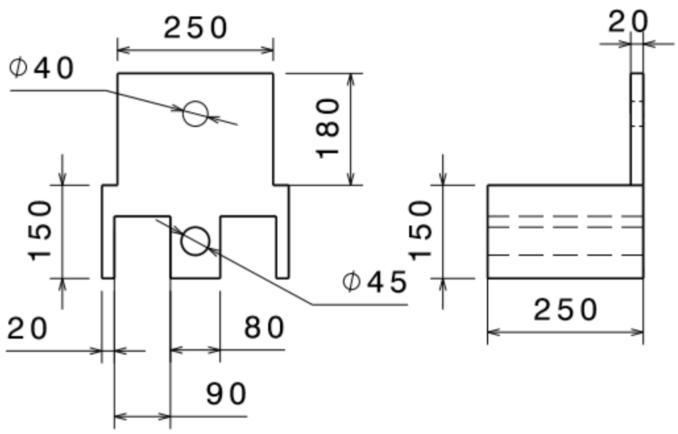

Fig 3.14: Detailed Diagram of Motor mounting block.

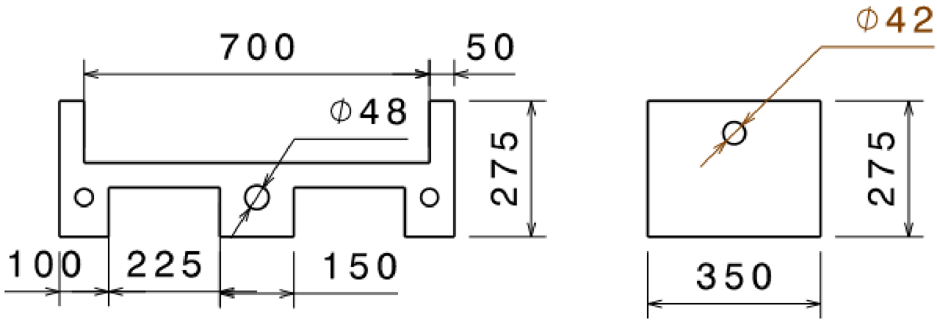

Fig 3.15: Detailed Diagram of Middle block.

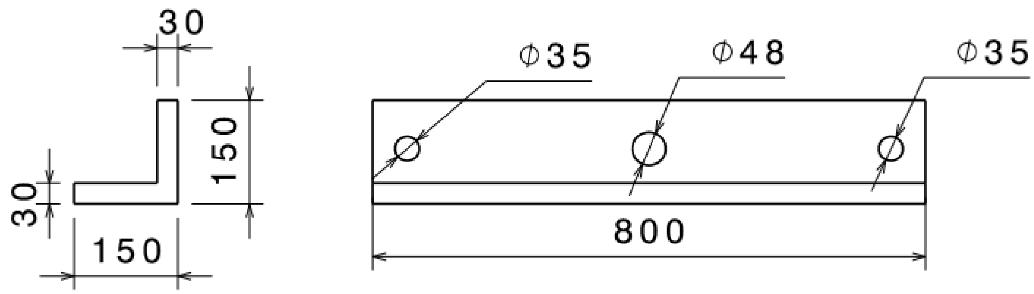

Fig 3.16: Detailed Diagram of L Plate Support For Guide Rod And Lead Screw.

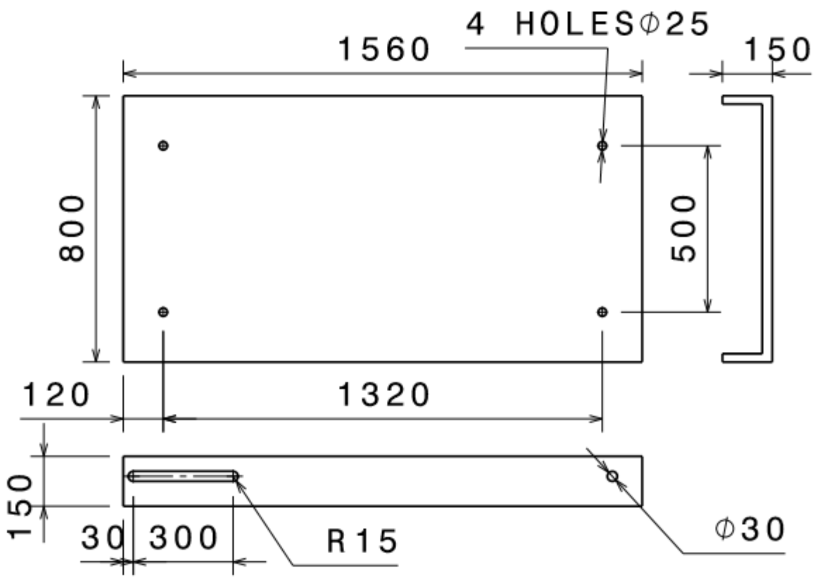

Fig 3.17: Detailed Diagram of Top Plate Of Scissor Lift.

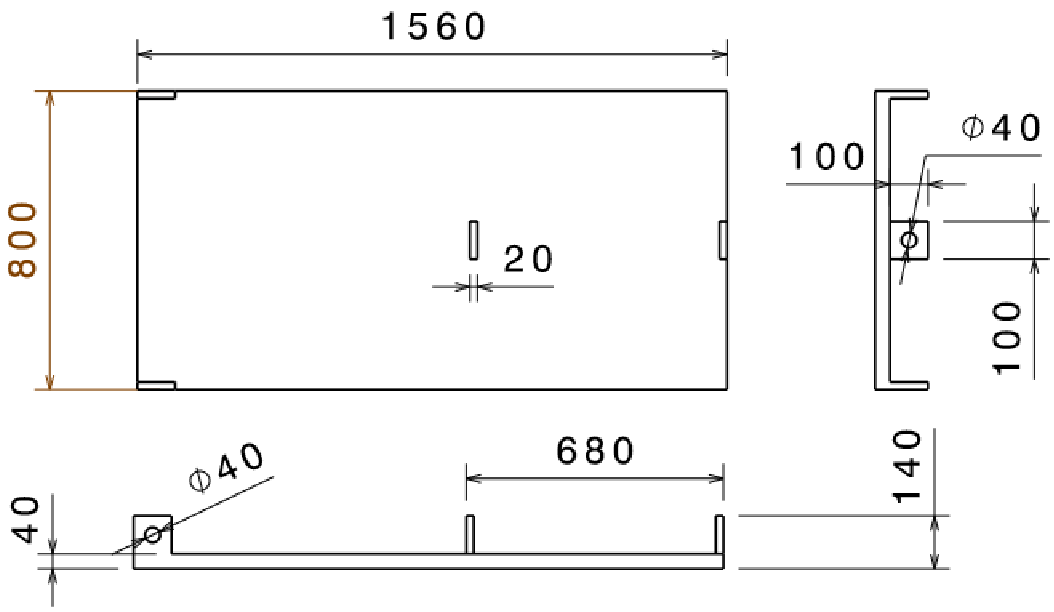

Fig 3.18: Detailed Diagram of Base Plate Of Scissor Lift.

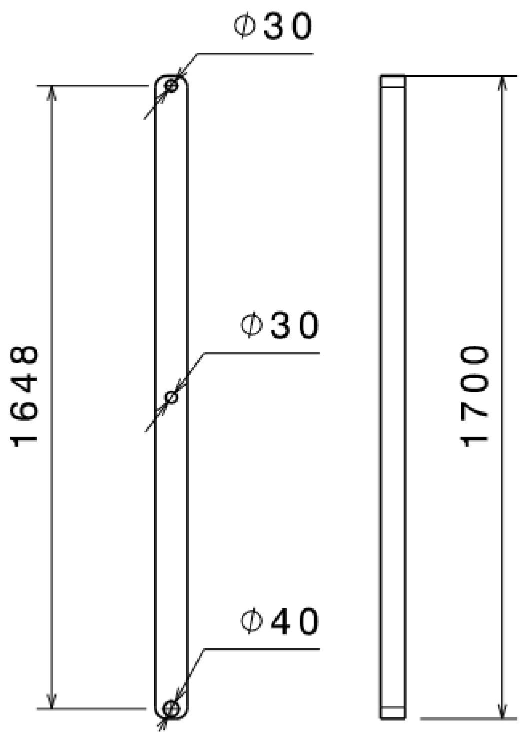

Fig 3.19: Detailed Diagram of Leg of Scissor Lift.

Part Name	**Material**	**Operation**	**Quantity**
Base	Acrylic	Drilling/ Facing/cutting	1
Middle Bed	Acrylic	Drilling/ Facing/cutting	1
Scissor Link	Aluminium	Cutting / Drilling/facing/Turning	4
Bottom Slider	Acrylic	Cutting / Drilling/facing/Turning	1
DC Motor For Lead Screw	M.S/Nylon	-	3
DC Motor For Scissor Mechanism	M.S/Nylon	-	1
Top Bed	Acrylic	Drilling/ Facing/cutting	1
Top Slider	Acrylic	Cutting/Drilling//facing	1
Top Lead Screw	MS	cutting / Drilling/Tapping/Facing	1
Middle Lead Screw	MS	cutting / Drilling/Tapping/Facing	1
Lead Screw For Scissor Lift	MS	cutting / Drilling/Tapping/Facing	1
Support M6 Rod.Dft	MS	Threading/cutting	2
L Support Plate	Foam PVC	Cutting / Drilling	2

Sr. No	Process	Time Required (BEFORE)	Time Required (AFTER)
1	Material handling	35 minutes	N.A
2	Cranes handling	70 minutes	N.A
3	Machine setting	15 minutes	15 minutes
4	Job setting	60 minutes	30 minutes
5	Drilling of both sides for steady pin	390 minutes	120 minutes
6	Unloading time	30 minutes	30 minutes
7	Shifting of job from machine shop to assembly shop	35 minutes	N.A
	Total Time Required	11-12 Hours	3-4 Hours

Results After Manufacturing Of Machine.

5. CONCLUSION:

With the help of current research, we briefed out the basic Design Procedure of the Mechanically Operated Scissor Lift working on the principle of Leadscrew. Moreover, we also explained the importance of some useful accessories such as Self Storing Maintenance Stand, Blocking Mechanism, Self Locking Pair, Loading by Saddle Plate, Stability Conditions as well as Controller Mechanism.

Scissor lift are a type of mechanism that allows for vertical displacement of some load through the use of linked, folding supports, in a crisscross X patter, referred to as a pantograph (or, simply, a scissor mechanism). Scissor lifts are widely used in industrial applications, and also from a staple design element in competitive robotics. Each arm of the crosses is called a 'scissor arm' or 'scissor member'. The upward motion is produced by the application of force, by some actuator (usually hydraulic, pneumatic, or mechanical) to the application to the outside of the one set of supports elongating the crossing pattern, and propelling the load vertically.

However, the positioning of the actuator, in terms of the point of application of the force on the pantograph, can affect the force required of the actuator for a given load. Prudent placement of the actuator can greatly reduce the force required and the stress levels in the adjacent scissor arms. We all know climbing stairs to foot over bridge for changing railway platform with heavy luggage is one of the major issue that every passenger and luggage carrier face during the beginning and end of the rail journey. Everyone wishes the arrival and dispatch of a train from platform no 1 without requiring climbing stairs. So changing the platform with heavy luggage by climbing stairs to foot over bridge every time is very tried and painful experience for everyone.

Portable work platform Mechanical scissor lift is designed for high load resistance. The Mechanical scissor lift is simple in use and does not required routine maintenance. Both the mild steel and aluminium alloy are good at their different aspet Mild steel has greater durability strength and it is also cheap and easily available. As these properties plays an important role in designing scissor lift. So in designing scissor lift mild steel has greater importance.

6. FUTURE SCOPE

In Today's industries have a conventional fixed Drilling Machines for Machining operation of pumps. To carryout operation on large pump such as series five pump which is mentioned in above in problem statement. It is need of today and for better future in manufacturing process to develop a versatile drilling machine. Which has a unique mechanism and has mobility to vary shop and without moving these large pump or components drilling operation could be carryout? Predecessors machine were good when it comes to operation on small scale but for high mass production it won't be convenient to use bulky conventional drilling machine.

Industrial Portable Drilling Machine is designed according to industry needs and considering all the parameter while performing operations. Current machine is operated with help of servo motors controlled by electric switches. It can be upgraded in future for ease of operation.

1. Mass optimization of machine using light weight material that has high strength to weight ratio.
2. Control panel can be upgraded by using PLC's system.
3. Computerized Numerical version of this machine could be possible in future.
4. This machine not only used for large pump but operation on small pump can be possible.

7. REFERENCES

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